

Mediastinitis Complicated by Ludwig's Angina Secondary to Alveolodental Abscess

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Abstract

The objective of this study is to describe a case report of Ludwig's angina of odontogenic origin, which evolved with airway obstruction requiring emergency tracheostomy. A 16-year-old adolescent was admitted with Ludwig's angina complicated with mediastinitis, confirmed by contrast computed tomography. Antibiotic therapy and surgical drainage were instituted, but 2 days later she was admitted to the intensive care unit due to hemodynamic instability. She also evolved with airway obstruction, and emergency tracheostomy was performed. A new computed tomography scan of the cervicothoracic region was performed, which showed collections in the neck and mediastinum, with new extensive drainage and minimal thoracotomy and antibiotic escalation. She had a satisfactory clinical evolution and was discharged without sequelae after 11 days.

Keywords

Ludwig's Angina, Mediastinitis, Tracheostomy

1. Introduction

Ludwig's angina is a severe and rapidly progressing bacterial infection that affects the submandibular, sublingual, and submental spaces [1]. It is characterized by a severe, diffuse inflammatory process, usually originating from odontogenic infections. It predominantly affects adults, with a higher incidence in immunocompromised individuals. Diagnosis is often clinical, based on the presentation of symptoms such as neck swelling, fever, trismus, and respiratory difficulty. Contrast-enhanced computed tomography (CT) is the preferred imaging modality to assess the extent of the infection. Management of Ludwig's angina involves airway pro-

tection, broad-spectrum antibiotic therapy, and surgical intervention for abscess drainage and tissue debridement. The introduction of antibiotics in the 1940 s significantly reduced mortality, but it still requires immediate medical attention [2]. The most feared complication is the spread of the infection to the mediastinum, leading to mediastinitis, a highly lethal condition with a mortality rate above 40% [3].

2. Etiology

The main cause of Ludwig's angina is odontogenic in origin, primarily involving the molars, particularly the second and third molars, accounting for 90% of cases. Other possible etiologies include injury or laceration of the floor of the mouth, mandibular fractures, tongue lesions, oral piercings, intubation trauma, peritonsillar abscess, and infection of the thyroglossal cyst [3].

Predisposing factors include diabetes mellitus, oral malignant lesions, poor dental hygiene, alcoholism, malnutrition, and immunosuppression. In the presented case, the patient had an alveolodental abscess and did not have other significant predisposing factors [2] [3].

3. Microbiology

The disease is typically polymicrobial and involves both aerobic and anaerobic oral flora. *Staphylococcus*, *Streptococcus*, *Peptostreptococcus*, *Fusobacterium*, *Bacteroides*, and *Actinomyces* are the most common organisms. Infection with *Streptococcus anginosus* causes the disease to progress more rapidly than other bacteria. Cultures from more than half of patients with Ludwig's angina and diabetes show *Klebsiella pneumoniae* as the causative agent. Patients with diabetes, chronic kidney disease on hemodialysis, and a history of recent hospitalization are at increased risk of infection with methicillin-resistant *Staphylococcus aureus* (MRSA) [3] [4].

4. Epidemiology

Ludwig's angina does not show a significant gender predilection. Airway compromise and mediastinitis are the main causes of mortality. Before the development of antibiotics, mortality exceeded 50%. Rapid airway management, antibiotic therapy, advanced imaging, and surgical procedures have decreased mortality to around 8% [2].

5. Clinical Manifestations

The most common symptoms are dysphagia, dysarthria, odynophagia, otalgia, voice changes, sore throat, fever, and neck stiffness. The clinical appearance is often described as a "bull-neck," with increased fullness in the submental area and loss of definition of the mandibular angle. Upon examining the patient, edema of the neck, trismus, halitosis, sialorrhea, and gingival edema may be observed. The "double tongue sign" may be present, indicating elevation of the floor of the

mouth due to edema of the submandibular space. Lymphadenopathy, on the other hand, is not common in Ludwig's angina. Respiratory compromise may occur, with stridor being an indication of imminent airway obstruction. Respiratory compromise is the most common cause of death in Ludwig's angina. In the case presented, respiratory compromise was present, which led to an urgent tracheostomy [2] [5].

6. Diagnosis and Treatment

The diagnosis of Ludwig's angina is primarily clinical and is typically supported by imaging studies. The decision to perform orotracheal intubation should be based exclusively on clinical parameters, particularly in the presence of airway compromise.

Contrast-enhanced computed tomography (CT) of the neck is the imaging modality of choice for evaluating the extent of the infection and identifying potential abscess formation. Bilateral involvement of the cervical spaces is required to establish the diagnosis of Ludwig's angina. The characteristic CT findings may include the presence of gas within the soft tissues, fluid collections, muscular edema, attenuation of subcutaneous fat, obliteration of fat planes in the submylohyoid space, and thickening of the cervical soft tissues.

Laboratory investigations have limited diagnostic value, as clinical evaluation remains the cornerstone of diagnosis. However, blood cultures are recommended to assess for possible hematogenous dissemination of the infection [2].

7. Differential Diagnosis

The differential diagnosis includes peritonsillar abscess, retropharyngeal abscess, submandibular abscess, epiglottitis, oral carcinoma, angioedema, and submandibular hematoma. Although Ludwig's angina is a clinical diagnosis, it can be difficult to differentiate from other diseases, and imaging studies may be useful in this situation, both to confirm the diagnosis of Ludwig's angina and to exclude other causes. Imaging should only be requested when the patient's airway is secure, or in patients who are breathing comfortably and able to protect their airway [2] [6].

8. Treatment Approach

The essential components of Ludwig's angina treatment are securing the patient's airway, administering antibiotics and performing surgical intervention. Airway monitoring and protection are the most critical aspects of Ludwig's angina management.

Surgical incision and drainage are considered the cornerstone of treatment, along with the use of broad-spectrum antibiotics until culture results can identify the causative organism. In cases of large abscesses or involvement of multiple spaces, an open incision and drainage should be performed immediately. The surgical incision is typically made parallel and 2 cm below the mandibular angle. The location and size of the initial incision will depend on the specific anatomical

spaces involved by the infection, and in severe cases, it may need to extend to the midline below the chin. Multiple incisions may be required to achieve complete drainage. The superficial lobe of the submandibular gland should be displaced, and the mylohyoid muscles should be divided to decompress the fascia and the spaces involved in the septic process. Dissection should be performed to explore the affected compartments and to break up any loculations. Drains should be placed in the fascial compartments to prevent reaccumulation of necrotic debris and pus [7] [8].

Surgical intervention is crucial for both pus removal and decompression of the head and neck fascial spaces. Securing a patent airway is the primary concern and may require urgent tracheostomy. The airway is often compromised in Ludwig's angina, and in such cases, fiberoptic intubation via the nasal route is indicated. Orotracheal or nasotracheal intubation may be impossible due to the anatomical compromise caused by the infection, the risk of airway trauma, pus rupture into the oral cavity with bronchopulmonary aspiration, and the potential to induce severe laryngospasm. If intubation via bronchoscopy is not feasible, airway management becomes surgical through tracheostomy [9] [10].

The antimicrobial regimen is chosen empirically based on the microorganisms expected to cause the infection. The antibiotic therapy should be adjusted once a pathogen is isolated. The choice of regimen depends on the patient's immune status. It typically includes broad-spectrum antibiotics capable of targeting both aerobic and anaerobic organisms [11]-[13]. For immunocompetent patients, ampicillin-sulbactam, ceftriaxone plus metronidazole, or meropenem may be used. For patients at high risk of methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin or linezolid is recommended. In immunocompromised patients, cefepime plus metronidazole, meropenem, or piperacillin-tazobactam may be used, along with vancomycin or linezolid if MRSA is suspected [14].

Despite the controversial role of corticosteroids, they may be administered alongside antibiotics to reduce edema. It is essential to highlight that patients should receive treatment in an intensive care unit [3].

9. Case Report

A 16-year-old adolescent with a history of alveolodental abscess following tooth extraction was admitted to the emergency department with complaints of dyspnea, chest pain, and odynophagia. Physical examination revealed tachypnea, increased volume in the cervical region, and tachycardia. Given the patient's history, the initial diagnosis was Ludwig's angina.

The complete blood count showed leukocytosis of 14,520/mm³ and 87% neutrophils, the blood culture and purulent secretion culture were negative, but the bronchial secretion culture revealed the presence of *Pseudomonas aeruginosa*, sensitive to gentamicin and resistant to meropenem and levofloxacin.

The contrast-enhanced CT of the cervical region revealed multiple collections and gas in the submandibular spaces, confirming the diagnosis. Antibiotic therapy

was initiated, and the collections were drained.

On the second day, the patient developed hemodynamic instability (MAP: 53 mmHg), which was resolved with norepinephrine, and airway obstruction. An emergency tracheostomy was performed, and a new CT scan of the cervical-thoracic region showed collections in the neck and mediastinum (**Figure 1(A)-Figure 1(C), Figure 2(D)-Figure 2(F)**). There was recurrence due to collections that had not been drained. Extensive drainage of the bilateral submandibular and retromandibular spaces, cervical space, and a minimal thoracotomy for right external access at the 4th intercostal space with aspiration of 400 mL of pus was performed. Five laminar drains were placed, and the antibiotic regimen was escalated with vancomycin and meropenem.

The patient was discharged without sequelae after 11 days. Mediastinitis suspicion should be considered in patients with alveolodental abscess. Early diagnosis and multidisciplinary therapy contributed to a satisfactory outcome.



Figure 1. There is an extensive hypoattenuating collection with gaseous content, occupying the bilateral parapharyngeal, sublingual and submandibular spaces and the space adjacent to the submandibular glands, extending into the mediastinum between the sternocleidomastoid muscles and the thyroid gland.

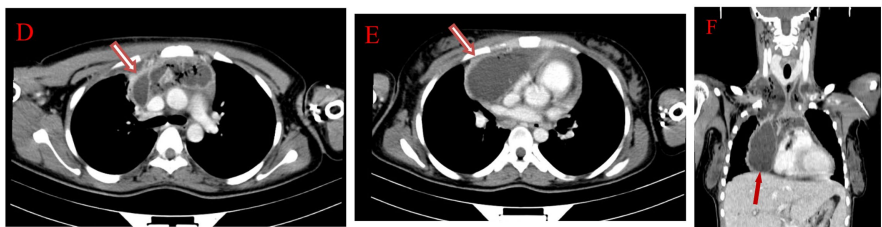


Figure 2. It is observed voluminous collection with gaseous content can be seen occupying the entire mediastinum up to the right paracardiac region.

10. Discussion

Ludwig's angina is an extremely severe clinical condition with a high potential for complications, particularly concerning airway obstruction. It may also progress to sepsis and mediastinitis, as observed in the patient described in this case report. The Contrast-enhanced CT was the initial examination of choice due to its speed and accuracy in assessing Ludwig's angina, as well as its accessibility compared to magnetic resonance imaging (MRI). In some selected cases, MRI may be used to better characterize the infection [1].

In the reported case, unfortunately, the surgical procedure was not carried out as described in the literature due to technical difficulties, leading to the postponement of the wide surgical approach, which resulted in the worsening of the condition within 2 days. The literature clearly discusses the urgent need for surgical intervention.

Broad-spectrum antibiotics serve as the first-line treatment and should cover both aerobic and anaerobic oral flora. The choice of antimicrobials in this case was empirical and based on local antimicrobial resistance profiles, which showed a good therapeutic response. Purulent secretion cultures in Ludwig's angina may yield negative results, as described in the literature. This can occur for several reasons: patients who have received antibiotics prior to culture collection may have a reduced bacterial load, leading to a negative result; improperly collected samples or failure to perform the appropriate tests to identify anaerobic bacteria; samples that are not obtained from the most affected areas or insufficient material being collected. Therefore, even if purulent secretion cultures yield negative results, the possibility of infection should still be considered, and empirical treatment should be initiated until more definitive results are obtained. Although clinical evolution is a central criterion, it should not be the sole method of evaluation. Continuous monitoring and additional tests, such as microbiological cultures, may be necessary to adjust therapy and ensure complete resolution of the infection [11] [15].

In some cases, where no obvious abscesses are present and the patient maintains respiratory stability, conservative treatment may be attempted. In other cases, if the collections are small and well-localized, minimally invasive percutaneous drainage guided by ultrasound or CT may be considered. However, in this particular case, multiple collections were found in the soft tissues of the neck and at the mediastinal level, requiring an aggressive approach with wide surgical drainage of the purulent collections to control the infection and tracheostomy to maintain the airway.

In cases of Ludwig's angina, the primary concern is the patient's airway. Based on the patient's clinical presentation, it is essential to determine whether or not to proceed with an advanced definitive airway. These patients typically have an airway that is extremely difficult to intubate, with laryngoscopy being complicated by trismus and tongue elevation. Tracheostomy is also technically challenging and dangerous, but may be required in emergency situations. The literature indicates that the safest method for securing an advanced airway in these patients is through awake bronchoscopy. Another concern is the progression to sepsis, as well as infectious involvement of the mediastinum, as was seen in our patient. The patient was also clearly septic, and sepsis protocols were applied accordingly [16].

11. Conclusion

Follow-up of the post-Ludwig's angina patient should be multidisciplinary to ensure recovery of respiratory and swallowing function, maintain exercises to avoid

dysphagia, and strengthen the oropharyngeal muscles. Identifying and treating remaining dental infections, which are the main cause of Ludwig's angina, should also be part of the follow-up. Long-term, the focus should be on preventing recurrences, controlling predisposing factors, and functional rehabilitation. With proper follow-up, most patients fully recover without significant sequelae. The prognosis of the patient depends on how quickly Ludwig's angina was diagnosed and treated. When the infection is properly managed with antibiotics, drainage, and airway control, the recovery rate exceeds 90% [17].

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Bridwell, R., Gottlieb, M., Koyfman, A. and Long, B. (2021) Diagnosis and Management of Ludwig's Angina: An Evidence-Based Review. *The American Journal of Emergency Medicine*, **41**, 1-5. <https://doi.org/10.1016/j.ajem.2020.12.030>
- [2] Saifelddeen, K. and Evans, R. (2004) Ludwig's Angina. *Emergency Medicine Journal*, **21**, 242-243. <https://doi.org/10.1136/emj.2003.012336>
- [3] An, J., Madeo, J. and Singhal, M. (2023) Ludwig Angina. StatPearls Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK482354/>
- [4] Vieira, F., Allen, S.M., Stocks, R.M.S. and Thompson, J.W. (2008) Deep Neck Infection. *Otolaryngologic Clinics of North America*, **41**, 459-483. <https://doi.org/10.1016/j.otc.2008.01.002>
- [5] Shockley, W.W. (1999) Ludwig Angina: A Review of Current Airway Management. *Archives of Otolaryngology—Head & Neck Surgery*, **125**, 600. <https://doi.org/10.1001/archotol.125.5.600>
- [6] Parhiscar, A. and Har-El, G. (2001) Deep Neck Abscess: A Retrospective Review of 210 Cases. *Annals of Otolaryngology, Rhinology & Laryngology*, **110**, 1051-1054. <https://doi.org/10.1177/000348940111001111>
- [7] Vallée, M., Gaborit, B., Meyer, J., Malard, O., Boutoille, D., Raffi, F., *et al.* (2020) Ludwig's Angina: A Diagnostic and Surgical Priority. *International Journal of Infectious Diseases*, **93**, 160-162. <https://doi.org/10.1016/j.ijid.2020.01.028>
- [8] Candamourty, R., Venkatachalam, S., Ramesh Babu, M. and Kumar, G. (2012) Ludwig's Angina—An Emergency: A Case Report with Literature Review. *Journal of Natural Science, Biology and Medicine*, **3**, 206-208. <https://doi.org/10.4103/0976-9668.101932>
- [9] Pappa, H. and Jones, D.C. (2005) Mediastinitis from Odontogenic Infection. A Case Report. *British Dental Journal*, **198**, 547-548. <https://doi.org/10.1038/sj.bdj.4812302>
- [10] Daniel, B. (2023) Estudos em Ciências da Saúde no Brasil: Produções multidisciplinares no século. Gerenciamento das vias aéreas em infecções cervicais profundas e angina de ludwig. Cap 3, 32-37.
- [11] Tiago, F., *et al.* (2012) Ludwig's Angina: Diagnosis and Treatment, Literature Review Article.
- [12] Brook, I. (2007) Microbiology and Principles of Antimicrobial Therapy for Head and Neck Infections. *Infectious Disease Clinics of North America*, **21**, 355-391. <https://doi.org/10.1016/j.idc.2007.03.014>

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- [13] Vieira, F., Allen, S.M., Stocks, R.M.S. and Thompson, J.W. (2008) Deep Neck Infection. *Otolaryngologic Clinics of North America*, **41**, 459-483. <https://doi.org/10.1016/j.otc.2008.01.002>
- [14] Duprey, K., Rose, J. and Fromm, C. (2010) Ludwig's Angina. *International Journal of Emergency Medicine*, **3**, 201-202. <https://doi.org/10.1007/s12245-010-0172-1>
- [15] Begum, S., Roy, S. and Yusuf, M.A. (2015) Anaerobic Bacteria: Infection and Management. *IOSR Journal of Dental and Medical Sciences*, **14**, 69-72.
- [16] Jiménez, Y., Bagán, J.V., Murillo, J. and Poveda, R. (2004) Odontogenic Infections. Complications. Systemic Manifestations. *Medicina Oral, Patología Oral, Cirugía Bucal*, **9**, 139-147.
- [17] Parker, E. and Mortimore, G. (2019) Ludwig's Angina: A Multidisciplinary Concern. *British Journal of Nursing*, **28**, 547-551. <https://doi.org/10.12968/bjon.2019.28.9.547>